

THE RIVER AND THE BASIN

Measuring
Monitoring
Controlling
Allocating

Mountain laurel, the official flower of the Commonwealth of Pennsylvania, is common in the Basin—and not confined to mountains alone.

HYDROLOGIC REPORT

Too much. Too little.

Mother Nature all too often seems to have problems providing just the right amount of water to all places at all times. Nineteen ninety-seven was no exception.

The year began with unusually high storage levels in most reservoirs: the two largest Delaware Basin reservoirs, Cannonsville and Pepacton, were actually spilling at the start of the year. This caused major concerns regarding potential flooding in the areas downstream from the reservoirs. The flooding that occurred in January 1996 was still fresh in the minds of area residents. They recalled that reservoirs were low at the time and thus had the capacity to hold back more than 45 billion gallons, thereby reducing the severity of the flooding.

In response to many requests, including letters to the member governors of the Delaware River Basin Commission, the Commission adopted a Resolution (No.97-2) on January 22, 1997, recommending that Pepacton Reservoir be drawn down with releases until a storage volume of 5 billion gallons was available for emergency storage. All parties to the 1954 U.S. Supreme Court decree, including the City of New York, agreed to the resolution. Reserves were released, and the reservoir remained below full until March. It was then allowed to refill to be available for later use if and when needed for water supply and/or downstream releases. Fortunately, no major storms occurred during this period.

Below-average precipitation during January and February was of little concern since the reservoirs were full. However, continued below-average precipitation from April through July required significant directed releases from the reservoirs to maintain the minimum required flow in the Delaware River. On August 6, the Commissioners, with the concurrence of New York City, met and, in an effort to conserve as much storage as possible, agreed to bank (retain) the remaining quantity of excess release water. Banking the remaining excess release water delays entering drought warning if storage continues to decrease. By the end of September, the nearly seven inches of precipitation deficit had also caused ground-water levels to fall below average, and purveyors were starting to experience problems with poor yields from supply wells.

Precipitation continued below average during September and October. On October 22, storage in the New York City Delaware River Basin reservoirs dropped below the drought warning level. Five days later, a drought warning for the Delaware River Basin was officially declared. This was the ninth drought warning for the Basin since the early 1980s when the drought plan was adopted. Twice, in 1981 and 1985, conditions worsened and the Commission declared

drought emergencies. The most recent drought warning occurred in September 1995 and lasted roughly two months.

Even with drought warning operations in place, storage continued to drop until November 1, when storage was only 98 billion

gallons, or 36.5 percent of capacity. However, more precipitation in parts of the Basin and substantially reduced diversions by New York City allowed storage to increase slowly. By the end of 1997, storage was 126 billion gallons, or 46.8 percent of capacity, but the Basin would remain in drought warning into 1998 until storage increased to 15 billion gallons above drought warning for five days.

While 1997 began with reservoirs full and a concern for potential flooding, the year ended in drought warning and fear that the reservoirs might not refill for the summer/fall drawdown season. Once again Mother Nature proved to be a very fickle lady.

GROUND-WATER REGULATIONS

Public's Feedback Shapes Commission's Approach

The Commission devoted much time and discussion to proposed regulations that would establish numerical ground-water withdrawal limits for subbasins in portions of southeastern Pennsylvania. Several well-attended public meetings, together with written comments from many interested parties, were strongly influential in determining the regulations' final shape.

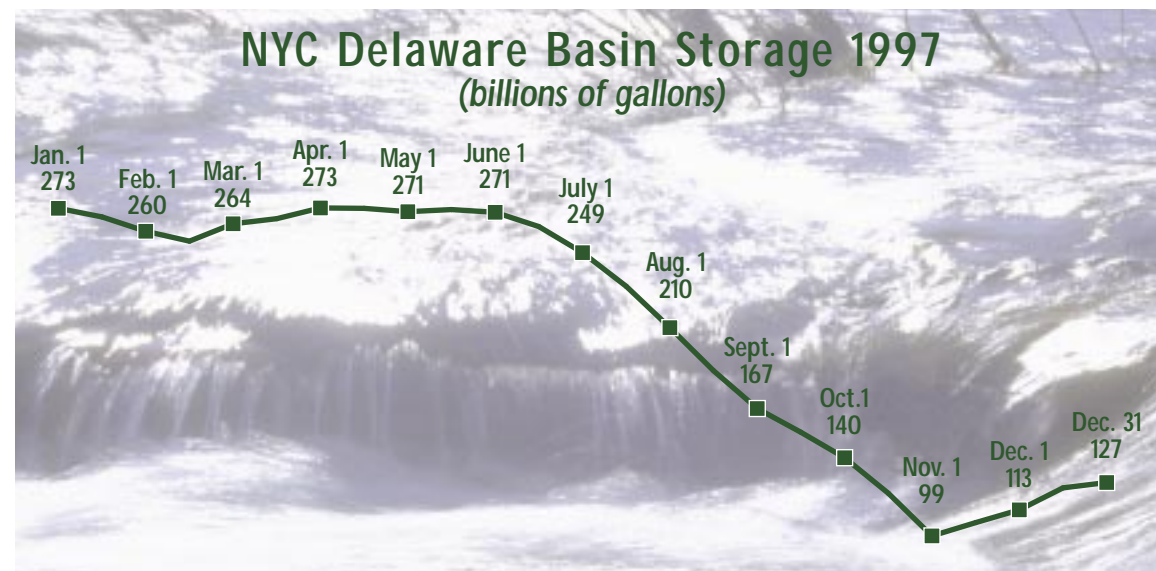
The U.S. Geological Survey in cooperation with the Commission prepared the ground-water study that provided the base flow analyses for geologic formations in the 14 subbasins, or watersheds, in the Neshaminy Creek Basin. Limits for the remaining 52 subbasins within the Ground Water Protected Area of Southeastern Pennsylvania are being established as additional base flow analyses are completed.

In 1980 at the request of the Commonwealth of Pennsylvania, the Commission established the Southeastern Pennsylvania Ground Water Protected Area, where more stringent regulations apply to ground-water withdrawals than they do in the rest of the Delaware River Basin. The goal is to prevent depletion of ground water, protect the interests and rights of lawful users of the same water source, and balance and reconcile alternative and conflicting uses of limited water resources in the region.

Ground-water pumping has contributed to reduced flows in streams in the area. Such reductions can interfere with instream and downstream water uses, adversely affect fisheries and other aquatic life, and reduce the capacity of streams to assimilate natural and man-made pollutants.

While it is clear that ground-water withdrawals can affect the flows of perennial streams, it has been difficult to address the impact on stream flow on a project-by-project basis. The regulations address that problem by evaluating the cumulative impacts of all withdrawals within a subbasin.

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The regulations create a two-tiered system of withdrawal limits. The first tier serves as a warning that a subbasin is “potentially stressed.” In potentially stressed subbasins, the regulations will require applicants for new or expanded ground-water withdrawals to implement one or more programs to mitigate adverse impacts of additional ground-water withdrawals. Acceptable programs include: conjunctive use of ground water and surface water; expanded water conservation programs; programs to control ground-water infiltration; and artificial recharge and spray irrigation.

The second tier serves as the maximum withdrawal limit. Under the new regulations, ground-water withdrawals may not exceed that limit.

The proposed regulations also:

- Provide incentives for holders of existing DRBC dockets and protected area permits to implement one or more of the first-tier programs to reduce the adverse impacts of their ground-water withdrawals. If docket or permit holders successfully implement one or more programs, the Commission will extend the docket or permit for up to 10 years.
- Specify criteria for the issuance and review of dockets and permits, as well as procedures for revising withdrawal limits to correspond with integrated water resource plans adopted by municipalities for subbasins.
- Establish protocols for updating and revising withdrawal limits to provide additional protection for streams designated by the Commonwealth of Pennsylvania as “high quality,” or “wild, scenic or pastoral” as defined by the state’s scenic rivers program.

Reduced stream flow from ground-water pumping can harm aquatic life and limit the capacity of streams to assimilate pollutants.



SURFACE-WATER QUALITY

Our Primary Concern

The Commission continued to supervise development of the estuary waste-assimilative model that is being completed under a contract with HydroQual, Inc., a mathematical modeling firm.

The model, successor to an earlier less sophisticated one, helps to address a constant problem: what is the pollutant loading of the estuary in wet and dry seasons and how can it be controlled? The computer model simulates the fate and transport of pollutants and helps to determine cost-effective solutions to the problems they pose.

During the model’s development, Commission staff incorporated suggestions of the Peer Review Team, comprised of renowned scientists and engineers with modeling expertise, and other members of the Estuary Model and Combined Sewer Overflow Subcommittees. The dry-weather component of HydroQual’s estuary assimilative model is nearly complete. The new model incorporates a representative kinetic structure, is time variable, and is three dimensional. It replaces the old estuary model that was developed in the 1960s and that no longer accurately represents estuarine environmental processes.

The model has been calibrated against low-flow, summer conditions for dissolved oxygen, nitrogen, phosphorus, and chlorophyll concentrations. The model does not completely predict surface-water quality (dissolved oxygen concentrations) at all locations. The team has yet to identify why model data occasionally depart from actual concentrations in this manner, but there is an indication that aquatic vegetation and bivalves may be implicated.

The Peer Review Team deemed the model sufficiently developed so that the Commission could use it to evaluate the impacts of various wastewater treatment schemes on dissolved oxygen. The Team further suggested that an interagency work group, comprised of regulators from the Basin area, be convened to compute total maximum daily loads to the estuary. The summer of 1998 is the target date for convening the work group, for final documentation of the model, and for training of regulators and the regulated community.

To evaluate the impacts of aquatic vegetation and bivalves on water quality and to better predict surface-water quality, the Commission prepared field studies. It selected the Academy of Natural Sciences to conduct an aquatic vegetation study and the Delaware Department of Natural Resources and Environmental Control to conduct a bivalve study. Both field studies were completed in the summer of 1997 and both indicated substantial impact on water quality by aquatic life. However, the issue requires more study, partly because though emergent aquatic vegetation could be readily evaluated, the assessment of submerged vegetation was not com-

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pleted. Model runs to evaluate the impact of aquatic life, and possibly to recalibrate the model, have been scheduled for 1998.

The Peer Review Team and other members of the Estuary Model and Combined Sewer Overflow (CSO) Subcommittees (owner/operators of CSOs and the regulating agencies) assisted Commission staff in defining the scope of study for wet-weather modeling, which is scheduled for 1998. The wet-weather modeling will include development of a framework for mixing zones about clusters of CSOs. As an initial field study of the impact of CSOs, the Commission contracted HydroQual, Inc., for a dye study to evaluate CSO plumes. The field work, subcontracted to Ocean Surveys, Inc., was conducted in late November 1997. That study showed that initially the dye hugged the shoreline and did not completely disperse laterally. The Commission is seeking grants to fund additional studies of this and other types.

WATER SNAPSHOT '97

A Week in the Life

In 1996, the Commission took the lead in developing the first Water Snapshot event. Held during the week of Earth Day, Water Snapshot is an opportunity for every water quality monitoring program in the Delaware River Basin to sample water quality as one big Basinwide monitoring program. Co-sponsoring the event with the Commission have been the four basin states, the two Environmental Protection Agency regions, and the Delaware River Keeper Network.

Because *Water Snapshot '96* was so successful, the sponsors decided to launch the Water Snapshot as an annual event. EPA Region III in Philadelphia took the lead for running *Water Snapshot '97*, with the Commission and others helping out. A statewide Pennsylvania effort led by the Pennsylvania Department of Environmental Protection joined the Delaware River Basin effort in 1997. The two Water Snapshots were coordinated.

Water Snapshot uses six common parameters: water and air temperature; dissolved oxygen; pH; phosphorus, and nitrate-nitrogen. The volunteers also record observations concerning the presence of aquatic vegetation and animal life, recent rain, and other factors. Though limited, the information gathered by Water Snapshot has been quite effective in highlighting local problems as well as regional differences and the general “flow” of Delaware River Basin water quality from its headwaters, through its heart, and finally to the Atlantic Ocean.

For *Water Snapshot '97*, nearly 80 organizations sampled 350 locations on 172 streams and rivers. The real importance of Water Snapshot, however, is not the numbers, but the individuals. Water Snapshotters in both 1996 and 1997 ranged from elementary school students to citizen volunteers to water and wastewater treatment per-



RIGHT: DRBC staff members out of the office for a day participated in Water Snapshot '97 as they take samples from the Delaware River at the bridge above Lambertville.

ABOVE, RIGHT: The river is for all, and so are the little rivers that lead to the big ones, as this trio of young and old checks samples from a tiny tributary of the Delaware.

ABOVE, LEFT: DRBC staffers sample the river at Washington Crossing.



sonnel to Commission secretaries to scientists who work for government and private organizations. Just as the success of the Delaware River Basin's water pollution control efforts can be attributed to the dedication of many, so can each year's Water Snapshot.

A report on *Water Snapshot '97* is available from the Commission and can also be found on the Commission's web site at <http://www.state.nj.us/drbc/snap97.htm>

HEALTH CHECKS FOR BAY AND ESTUARY

Mid-Atlantic Integrated Assessment Program

The DRBC is a participant in a major federally managed undertaking to establish a baseline biological and taxonomic profile for the lower Delaware Estuary and Delaware Bay. The Mid-Atlantic Integrated Assessment Program began in 1997 under the auspices of the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency. Both the DRBC and the State of Delaware Department of Natural Resources and Environmental Control are providing local assistance to the federal project.

The purpose of the project is to determine a baseline health index for the bottom-dwelling, or benthic, community of organisms in the

bay and estuary. The data collected will also help to evaluate how significant the effects of various contaminants are in both distribution and magnitude.

Ninety-one sites within the estuary and in adjacent waters were sampled from the NOAA ship *Ferrel* and her small boats, augmented by additional small boats belonging to the State of Delaware.

The sampling fleet collected two samples of sediment from each site. One of each sample pair was sieved and preserved for later analysis of benthic taxonomy—i.e., biologic classification of sea-bottom-dwelling organisms in the samples. The other sample of each pair was used to determine sediment grain size and total organic carbon.

The scientists also examined the samples for the presence or absence of surface floc, color and smell, and any visible fauna. Conductivity, temperature, depth, and dissolved oxygen were also determined for each station. Additional surface, bottom, and mid-column water samples were

collected at a few stations to determine chlorophyll-a, particulate and dissolved nutrients, and suspended solids. Samples for future radionuclide and sediment core analyses were also taken at a few selected sites.

Additional sediment samples were collected for amphipod (e.g., sand fleas) and sea urchin fertilization and embryonic development, as well as for toxicity tests, organic and metal contaminant analyses, ratios of silt to clay, and more.

Analyses of the mountain of data collected in the 1997 effort should be completed by the end of 1998.

AQUATIC PLANTS INDICATE RIVER'S HEALTH

Rooted Vegetation Can Show What's in the Water

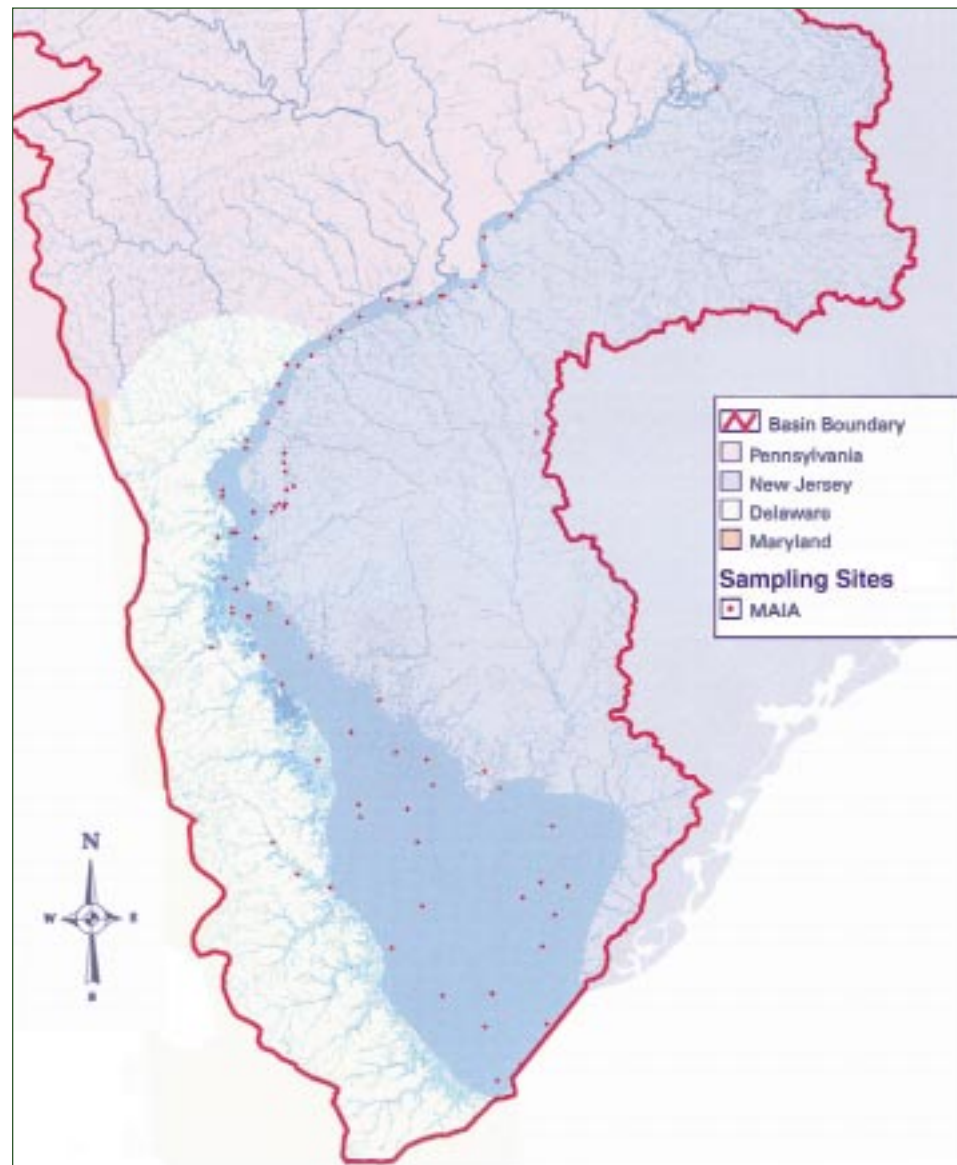
The Delaware River Basin Commission in cooperation with the Upper Delaware Scenic and Recreational River and the Delaware Water Gap National Recreation Area units of the National Park Service performed a rooted aquatic plant (macrophyte) biomass study in the Delaware River. The joint effort was part of the 1997 Scenic Rivers Monitoring Program. The study reach spanned 7.7 miles of the Delaware River from Port Jervis, N.Y., to Milford, Pa.

Aquatic plants are indicators of nutrient (nitrogen and phosphorus) discharges to waterways from wastewater treatment plants, malfunctioning septic systems, and runoff from fertilized lawns and agricultural practices. Since aquatic plants can also accumulate metals and polychlorinated biphenyls (PCBs), they are also being considered as a biological index for these contaminants.

Square-foot samples of entire plants were measured for average length, then collected, dried, and weighed for each of three plant genus: *Elodea* (water weed), *Potamogeton* (pond weed), and *Vallisneria* (eelgrass).

To determine the extent of plant beds, the study used traditional manual surveying methods and the Global Positioning System (GPS). People normally think of GPS as a navigational tool, a space satellite-based system that can determine a person's or an object's precise location on the Earth's surface. However, the system is just as precise in locating points around the boundary of an area and thus in determining the exact size of that area. And, in the aquatic environment in particular, GPS is far more convenient than manual surveying methods.

Having determined the area covered by the plants and knowing their weight per square foot, analysts could then calculate the total mass of a specific plant type in the region under study.



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The results from this study will be compared with those from a similar 1989 one that the DRBC and the Delaware Water Gap National Recreation Area performed in a subsection of this study reach. Findings from this study will serve to calibrate an aquatic-plant growth model for the Delaware River. The model, combined with a watershed model, will enable planners to determine how changes in various land uses in the adjoining watersheds may affect Delaware River water quality. Potential impacts on water quality will be reviewed to prevent changes to existing water quality as defined by the DRBC “Special Protection Waters” regulations.

PFIESTERIA'S WORRISOME NORTHWARD MARCH

Commission Co-sponsors Conference on Threat

Pfiesteria Piscicida (fee-STEER-ee-uh pis-uh-SEED-uh)—what is it? Despite the sound of its name, it's not a flowering plant.

Pfiesteria is a microscopic, free-swimming, single-celled organism—a dinoflagellate—that usually and harmlessly feeds on algae and bacteria. It was first identified only in 1991 by researchers at North Carolina State University who were seeking the cause of massive fish kills in North Carolina waters. The scientists found that under some conditions not fully understood Pfiesteria can shift form and emit a powerful neurotoxin that causes respiratory distress in fish. A second toxin dissolves the protective mucous and breaks down the fish's skin tissue, causing sores and bleeding. The organisms have caused fish kills and fish lesions in coastal waters from the Gulf of Mexico to, most recently, tributaries of Chesapeake Bay and Delaware inland bays, uncomfortably close to Delaware Bay.

Pfiesteria blooms have affected humans, not from eating infected fish, but merely because the people were in the area during the event. Symptoms include skin irritation, memory loss, nausea, and respiratory, kidney, liver, vision, and immune system problems.

To educate Basin citizens concerning Pfiesteria and the potential problem it poses to Basin waterways, the Commission co-

sponsored a conference with the Water Resources Association, the Susquehanna River Basin Commission, and the Partnership for the Delaware Estuary, Inc. Entitled “Pfiesteria—Facts and Fallacies,” the conference at the University of Delaware's Newark, Del., campus was attended by some 45 people who discussed the causes of Pfiesteria blooms, the organism's possible effects on the Basin environment and fish, and its northward migration.

THE GEOGRAPHIC INFORMATION SYSTEM

Steady Progress in Using Technology to Catalog the Basin

Our geographic information system (GIS) program, first brought online in 1996, progressed on several fronts in 1997.

These included: expanding the coverage of the Neshaminy Creek watershed; contracting with the U.S. Geological Survey (USGS) to complete a basic GIS water-use analysis program for the balance of the Southeastern Pennsylvania Ground Water Protected Area; coordinating funding efforts to obtain modern soils data for certain areas of the Basin; preparing base maps containing data layers, such as watershed boundaries, streams, political boundaries, and roads; preparing other data layers for staff to access on the DRBC network; and contracting with the New Castle Water Resources Agency to supplement GIS staffing needs.

Southeastern Pennsylvania Ground Water Protected Area

During 1997, the Pennsylvania District of the USGS continued to perform its contract with the DRBC to develop a basic GIS water-use analysis program for the balance of the Protected Area. It expects to complete this work in mid-1998. Geographically, this area includes all of Montgomery County, a significant portion of Bucks and Chester Counties, three townships in Berks County, and one in Lehigh County—a total of 127 municipalities in the 1,175 square miles. More than a million people reside within the Protected Area.

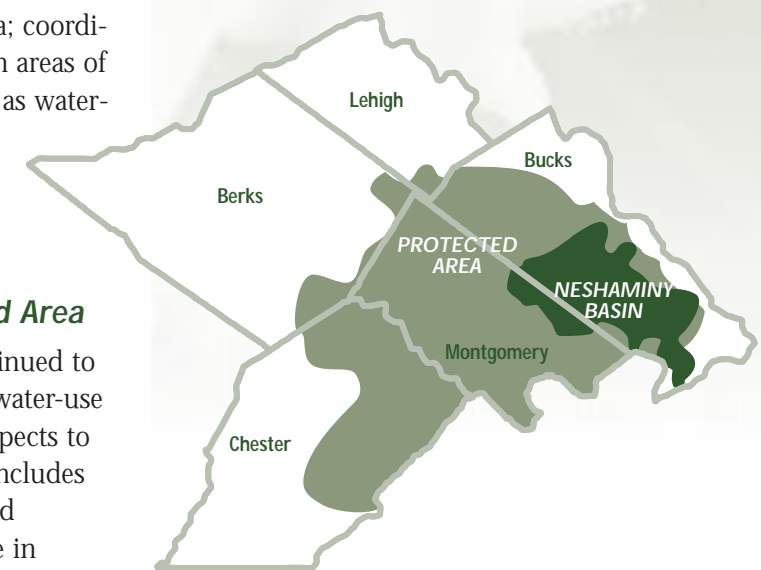
Neshaminy Project

The USGS, under a contract with the Commission, has developed a water-use analysis computer program for the Neshaminy Creek basin, a 232-square-mile watershed in a heavily populated area of southeastern Pennsylvania. The Neshaminy basin is located within the 1,200-square-mile Southeastern Pennsylvania Ground Water Protected Area, where special ground-water allocation requirements apply. The USGS effort involved the creation of several GIS data lay-

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Southeastern Pennsylvania Ground Water Protected Area



ers that included drainage basins, bedrock geology, and political boundaries. The USGS developed other information important to the water-use analysis aspects of the program. This included information on well and subsurface discharge locations, surface-water intakes, and outfall locations, along with some attribute data for each.

To demonstrate the utility of a GIS for the entire Ground Water Protected Area, the DRBC in 1997 began a pilot GIS to enhance the Neshaminy study and to make it more useful to the Commission's Project Review Branch and to other entities involved with planning. These enhancements include land-use and land-cover data, water quality monitoring sites, stream-gauging sites, wetlands, county and state parks, roads, railroads,

dams, and local boundaries. The Commission plans to add more data layers, including designated stream segments, flood plain delineation, soils, and hazardous waste sites. Upon completion, the data will be exported to a desktop program that will allow the user to visualize, query, and analyze the data spatially.

The DRBC acquired many data layers either from sources on the Internet or on compact disk (CD) from the Pennsylvania Department of Environmental Protection. Integral with expansion of the Neshaminy Creek GIS will be the

design, management, and construction of an overall database. Once completed, the Neshaminy basin pilot project will be used by government agencies and other entities in planning and other activities. Another measure of how effective the project is at filling in data gaps and keeping data current will be any partnership that develops between the Commission and the counties and other government agencies. Based on this effort's success, the Commissioners have agreed to establish a similar program for the remainder of the Pennsylvania Ground Water Protected Area.

Soils Data Needs

The Commissioners have shown great interest in developing GIS data that all levels of government and the private sector can use. During 1997, as Commission staff sought to determine priorities and possible funding sources, they found a lack of up-to-date soils data in digital GIS format for certain areas of the Basin. These data are useful in many water-related and land-use disciplines. At the end

of 1997, the DRBC made the first of several presentations seeking matching funds from the U.S. Army Corps of Engineers to support this initiative.

DRBC GIS Base Maps

The Commission began the GIS program in 1996, but lack of full-time staff impeded progress. Since completing their first effort of preparing a Basin map, staff members have used GIS to develop maps for presentations, reports, and other activities. In July, the Commission contracted with the New Castle County Water Resources Agency for its help in building basic data layers that the Commission staff could use. State agencies provide much of the data, the projections and format of which the DRBC must then adapt to meet its own needs.

The DRBC's GIS program has now reached the point where data layers are being loaded into the Commission's computer network. Staff can then readily access and use the data with Arc/View, a desktop mapping tool.

REGIONAL INFORMATION MANAGEMENT SERVICE

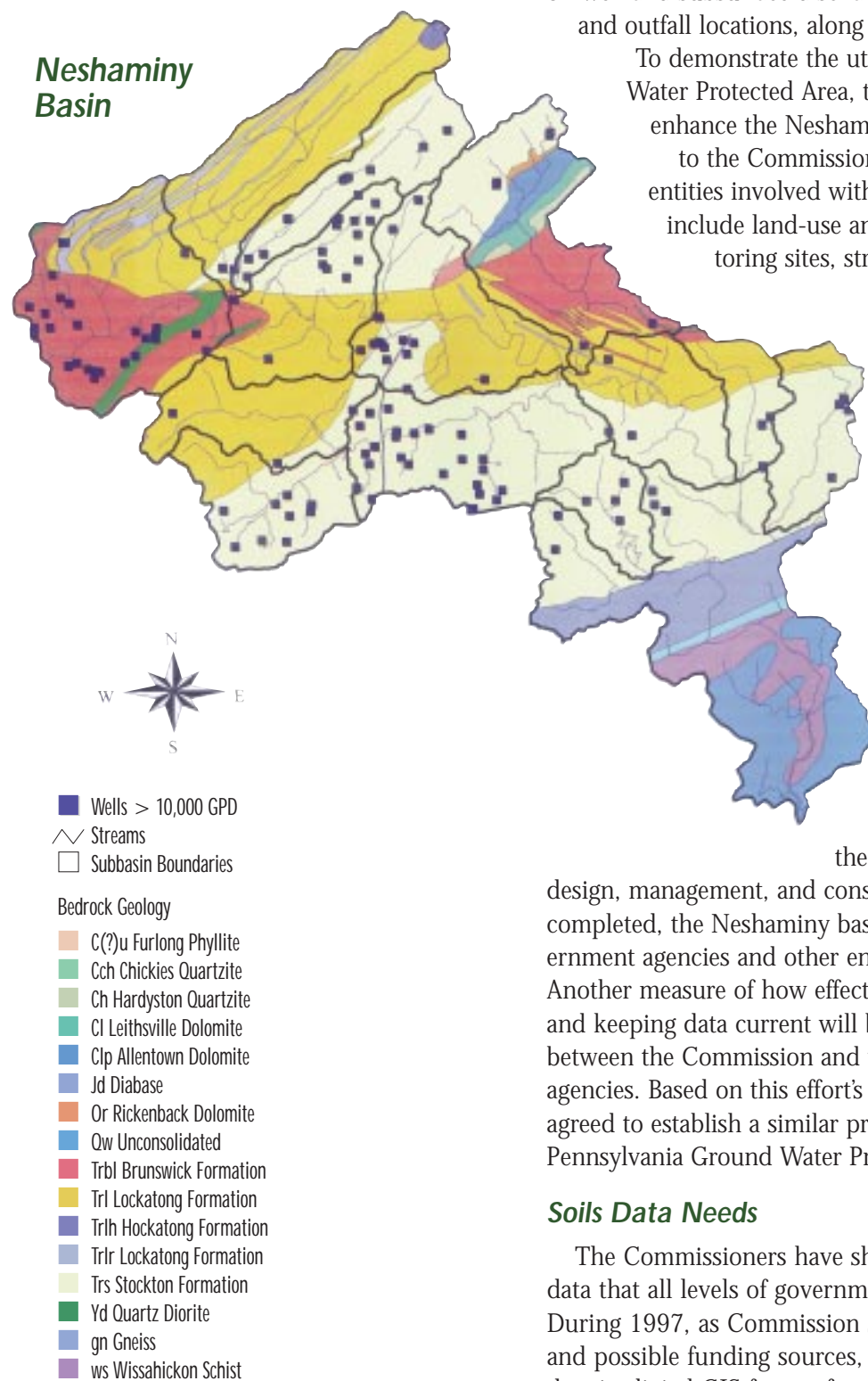
An Exciting Year for RIMS

Over the year the Regional Information Management Service (RIMS) underwent some exciting changes.

In early 1997, the Commission expanded the RIMS web pages to include a variety of environmental information, such as data links to volunteer organizations, a bibliography, a newsletter from the Delaware Estuary Program, and a data-source index file that enables users to search for archival environmental studies and other information.

As part of the RIMS outreach program, the Commission provided a workshop for some 25 school teachers as part of the Pennsylvania Education Institute Program. Run by the Pennsylvania Department of Conservation and Natural Resources, this program provided a week of training in environmental issues related to the Delaware Estuary. One introductory session on the use and purpose of RIMS on the web was conducted at the Commission's offices. Then most of the staff's personal computers were made available to the teachers so that they could connect to the Commission's web page through its network as well as to other web sites. The teachers' enthusiasm promoted interaction among the Commission staff itself regarding use of the Internet and personal computers to find and collect data and information relating to the estuary.

Later in 1997, the Commission hired a full time data manager for the RIMS. The web pages were revamped to help nontechnical users



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find information about recreational interests, such as boating and fishing. The new pages were also simplified to help others who might be having trouble finding specific information.

More changes are planned for 1998. These will expand the RIMS web pages to a new level. To stay abreast as the changes occur, point your web browser to <http://www.state.nj.us/drbc/rims.html>!

WATER REUSE AND GREY-WATER RECYCLING

Seminar Tackled Murky Topic

The Delaware River Basin Commission sponsored a seminar on Wastewater Reuse and Greywater Recycling on November 6, 1997, at the Grass Dale Center in Delaware City, Del. The seminar was promoted by several other organizations: the Water Resources Association of the Delaware River Basin, the American Water Works Association (Pennsylvania Section), the Water-Wise Council of New York, Inc., the Southeast New York Intergovernmental Water Supply Advisory Council, and the Water Resources Agency for New Castle County. About 120 people attended.

The one-day seminar was designed to give participants an introduction to this emerging technology, which presents industries and communities with an alternative to discharging effluent to sensitive waters. It also has become an attractive option for conserving and extending water supplies. Panelists consisting of local and national experts discussed opportunities and issues associated with wastewater reuse and grey-water recycling and successful case studies. The panel discussions were followed by a field trip to the New Castle County Spray Irrigation and Reclamation Plant near Odessa, Del.

Grey-water recycling has become an attractive option for conserving and extending water supplies.



INTEGRATED RESOURCE PLANNING SEMINAR

Symposium on Growth and Regulations

The Delaware River Basin Commission and the American Water Works Association co-sponsored a seminar on Integrated Resource Planning (IRP) on October 21, 1997, in Washington Crossing, Pa. The seminar was promoted by several other organizations: the Water Resources Association of the Delaware River Basin, the Delaware Riverkeeper Network, the Waterworks Operators' Association of Pennsylvania, the League of Women Voters of New Jersey, and the Pennsylvania State Association of Township Supervisors. About 100 people attended.

The one-day seminar presented information on several topics. In the morning, a national expert discussed the regulatory aspects of IRP, how IRP planning and execution are solving resource concerns, who is using IRP across the United States, components of IRP, and the importance of IRP in an increasingly competitive environment. In the afternoon, a panel of local experts discussed the applicability of IRP in the Delaware River Basin. A few of the many topics covered included: the proposed DRBC's regulations encouraging IRPs by municipalities in the Southeastern Pennsylvania Ground Water Protected Area, state efforts to promote IRP as part of their planning processes, how IRP is being used at the local level, utility perspectives on IRP, and the appropriateness of using IRP to plan growth while protecting environmental resources.

